

BELLINGHAM HARBOR, WASH.

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LETTER

FROM

THE SECRETARY OF THE ARMY

TRANSMITTING

A LETTER FROM THE CHIEF OF ENGINEERS, UNITED STATES ARMY, DATED MARCH 20, 1951, SUBMITTING A REPORT, TOGETHER WITH ACCOMPANYING PAPERS AND ILLUSTRATIONS, ON A REVIEW OF REPORTS ON BELLINGHAM HARBOR, WASH., REQUESTED BY A RESOLUTION OF THE COMMITTEE ON RIVERS AND HARBORS, HOUSE OF REPRESENTATIVES, ADOPTED ON AUGUST 30, 1944

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SEPTEMBER 30, 1952.—Referred to the Committee on Public Works and ordered to be printed with two illustrations (pursuant to Public Law 504, 82d Cong.)

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LETTER OF TRANSMITTAL

DEPARTMENT OF THE ARMY,  
*Washington 25, D. C., September 11, 1952.*

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

DEAR MR. SPEAKER: I am transmitting herewith a report dated March 20, 1951, from the Chief of Engineers, United States Army, together with accompanying papers and illustrations, on a review of reports on Bellingham Harbor, Wash., requested by a resolution of the Committee on Rivers and Harbors, House of Representatives, adopted on August 30, 1944.

In accordance with section 1 of Public Law 14, Seventy-ninth Congress, the views of the Governor, the State of Washington, and the Department of the Interior are set forth in the enclosed communications.

The Bureau of the Budget advises that while the expenditures of such large sums for works of this character would not be justified under existing restrictive budget policies, they would see no reason why the project should not be added to the list of improvements in the backlog of work to be undertaken when the Federal budgetary situation clearly makes possible the initiation of such projects. Accordingly, the Bureau of the Budget advises that there would be no

objection to the submission of the proposed report to the Congress or to the authorization of the recommended works. The complete views of the Bureau of the Budget are contained in the attached copy of its letter.

Sincerely yours,

FRANK PACE, Jr.,  
*Secretary of the Army.*

COMMENTS OF THE BUREAU OF THE BUDGET

EXECUTIVE OFFICE OF THE PRESIDENT,  
BUREAU OF THE BUDGET,  
*Washington 25, D. C., August 26, 1952.*

The honorable the SECRETARY OF THE ARMY,

(Through the Budget Officer for the Department of the Army).

MY DEAR MR. SECRETARY: Receipt is acknowledged of your letter of April 4, 1951, submitting the proposed report of the Chief of Engineers on Bellingham Harbor, Wash., requested by resolution of the Committee on Rivers and Harbors, House of Representatives, adopted August 30, 1944.

The Chief of Engineers recommends modification of the existing project for Bellingham Harbor, Wash., to provide for a small boat basin adjacent to Squalicum Creek waterway, the Federal work to consist of the construction and maintenance of two sections of rubble-mound breakwater, removal of the existing rubble-mound breakwater and use of the rock therefrom in the construction of the new structure, and maintenance of minimum depths of 12 feet in the entrances to the basin at an estimated cost to the United States of \$1,224,300 for new work and an additional \$13,500 annually for maintenance, subject to certain conditions of local cooperation. The plan of improvement appears to provide the best method of creating additional harbor space. The annual benefits estimated to accrue entirely to fishing and recreational craft would exceed the annual costs.

While the expenditure of such large sums for works of this character would not be justified under existing restrictive budget policies, we would see no reason why the project should not be added to the list of improvements in the backlog of work to be undertaken when the Federal budgetary situation clearly makes possible the initiation of such projects. Accordingly, you are advised that there would be no objection to the submission of the proposed report to the Congress or to the authorization of the recommended works.

Sincerely yours,

F. J. LAWTON, *Director.*

COMMENTS OF THE GOVERNOR OF THE STATE OF WASHINGTON

STATE OF WASHINGTON,  
EXECUTIVE DEPARTMENT,  
*Olympia, January 31, 1951.*

Maj. Gen. LEWIS A. PICK,  
*Chief of Engineers,*  
*Department of the Army, Washington 25, D. C.*

DEAR GENERAL PICK: Recent information has come to my office indicating an effort is being made by the city of Bellingham and interested people in that area for establishment of a small boat basin adjacent to Squalicum Creek waterway as a project to be constructed with Federal funds by the Corps of Engineers.

I am personally acquainted with the area in which the project is proposed and the need for it. It will be of much benefit to the local port and the people of Bellingham, as well as the State as a whole. This basin will become an integral part of the great fisheries resource development of the Northwest and is worthy of Federal support; therefore, I would like to endorse wholeheartedly its approval and ask that fullest consideration be given by your Department to adequate appropriation for it.

Sincerely,

ARTHUR B. LANGLIE, *Governor.*

COMMENTS OF THE STATE OF WASHINGTON

STATE OF WASHINGTON,  
DEPARTMENT OF CONSERVATION AND DEVELOPMENT,  
*Olympia, January 31, 1951.*

Maj. Gen. LEWIS A. PICK,  
*Chief of Engineers,*  
*Department of the Army, Washington 25, D. C.*

DEAR GENERAL PICK: Referring to our letter of December 18, 1950, dealing with an application for Federal aid in constructing a small boat basin adjacent to Squalicum Creek waterway at Bellingham, Wash., as a part of the Bellingham Harbor development, we attempted only to cover the requirements of the statute as provided in section 1, Public Law 14, Seventy-ninth Congress. In reviewing the report it was found that the construction in no way interfered with the State's interest including State's rights of water or property.

Since writing the routine letter covering the requirements of the law it has come to our attention that this development is highly desirable and one which will be of much benefit to the city of Bellingham and the State as a whole; therefore, we wish to supplement our letter by asking that it be given fullest consideration with an adequate appropriation for completion at the earliest possible date.

In further support we would like to say this particular project ties in with the development of fisheries in the Northwest and will be of considerable direct benefit to the port of Bellingham.

Very sincerely yours,

J. V. ROGERS, *Director.*

## COMMENTS OF THE STATE OF WASHINGTON

STATE OF WASHINGTON,  
DEPARTMENT OF CONSERVATION AND DEVELOPMENT,  
*Olympia, December 18, 1950.*

Maj. Gen. LEWIS A. PICK,  
*Chief of Engineers,  
Department of the Army, Washington 25, D. C.*

DEAR GENERAL PICK: Referring to your letter of December 8 transmitting review of reports on small boat basin adjacent to Squalicum Creek waterway at Bellingham, Wash., please be advised the State has no direct interest in this project, therefore, have no comments or recommendations to make.

Very sincerely yours,

J. V. ROGERS, *Director.*

## COMMENTS OF THE DEPARTMENT OF THE INTERIOR

DEPARTMENT OF THE INTERIOR,  
OFFICE OF THE SECRETARY,  
*Washington 25, D. C., March 13, 1951.*

Maj. Gen. LEWIS A. PICK,  
*Chief of Engineers, Department of the Army,  
Washington 25, D. C.*

MY DEAR GENERAL PICK: By letter dated December 8, 1950 (ENGWD), you transmitted for the information and comments of the Department copies of your proposed report on a review of reports on Bellingham Harbor, Wash., together with the reports of the Board of Engineers for Rivers and Harbors, and the district and division engineers.

The district engineer reports that increasing small-boat activities and lack of adequate moorage facilities in Bellingham Harbor necessitate enlargement of the present small-boat basin southeasterly of Squalicum Creek waterway and that general benefits therefrom are sufficient to warrant Federal participation in the improvement. He accordingly recommends that the existing navigation project for Bellingham Harbor be modified to provide for removal of the existing rubble-mound breakwater southeasterly of Squalicum Creek waterway and the construction of a new rubble-mound breakwater seaward of the existing one and in two sections, totaling 3,900 feet in length, as shown on the accompanying map, at an estimated Corps of Engineers first cost of \$1,224,300 and \$13,500 for annual maintenance above that now required, subject to certain conditions of local cooperation as outlined in the report. The Board of Engineers for Rivers and Harbors and the Chief of Engineers concur with the district engineer.

The Fish and Wildlife Service was consulted during the course of the investigation and offered no objection to the proposed work on the assumption that disposition of spoil would be carried out in accordance with plans available at that time. Subsequent information received indicates that there has been no change in the plan for disposal of spoil in connection with this harbor development. The Fish and Wildlife Service, therefore, has no objection to the proposed plan. However, if the spoil disposal area is inadequate or its location is changed, the Fish and Wildlife Service of the Department would



appreciate being consulted further in order that plans can insure that dredging will not interfere with the shell fish resource or aquatic food plants.

I am pleased to advise you that the favorable recommendations reached in your report will not adversely affect the interests of the Department.

Opportunity to review the report is appreciated.

Sincerely yours,

WILLIAM E. WARNE,  
*Assistant Secretary of the Interior.*

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REPORT OF THE CHIEF OF ENGINEERS, UNITED STATES ARMY

DEPARTMENT OF THE ARMY,  
OFFICE OF THE CHIEF OF ENGINEERS,  
Washington 25, D. C., March 20, 1951.

Subject: Bellingham Harbor, Wash.

To: The Secretary of the Army.

1. I submit herewith for transmission to Congress the report of the Board of Engineers for Rivers and Harbors in response to resolution of the Committee on Rivers and Harbors of the House of Representatives, adopted August 30, 1944, requesting the Board to review the reports on Bellingham Harbor, Wash., submitted in House Document No. 1161, Sixtieth Congress, second session, and subsequent reports, with a view to determining if it is advisable to modify the existing project in any way at this time.

2. After full consideration of the reports secured from the district and division engineers, and after affording local interests full opportunity to be heard, the Board recommends modification of the existing project for Bellingham Harbor, Wash., to provide for a small-boat basin adjacent to Squalicum Creek waterway, the Federal work to consist of construction and maintenance of two sections of rubble-mound breakwater with combined length of about 3,900 feet, removal of the existing rubble-mound breakwater now included for maintenance in the existing project and use of the rock therefrom in construction of the new breakwater, and maintenance of minimum depths of 12 feet in the entrances to the basin, generally in accordance with the plan of the district engineer and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable; at an estimated cost to the United States of \$1,224,300 for new work and \$13,500 annually for maintenance in addition to that now required; provided local interests agree to (a) furnish without cost to the United States all lands, easements, rights-of-way, and suitable spoil-disposal areas for the new work and for subsequent maintenance, when and as required, including title to the portion of the proposed breakwater already constructed by local interests and including the right to remove rock from the previously constructed project breakwater for use in the proposed Federal work; (b) hold and save the United States free from damages due to construction and maintenance of the improvement; (c) remove the timber-pile portions of the existing breakwater, perform all dredging required to provide and maintain in the basin a depth of 12 feet at mean lower low water; (d) construct protective dolphins at

the ends of the breakwaters when and as required; and (e) provide, maintain, and operate adequate moorage facilities, utilities, and a public landing with suitable service and supply facilities open to all on equal terms.

3. After due consideration of these reports, I concur in the views and recommendations of the Board.

LEWIS A. PICK,  
*Major General, Chief of Engineers.*

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REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS

DEPARTMENT OF THE ARMY,  
BOARD OF ENGINEERS FOR RIVERS AND HARBORS  
*Washington 25, D. C., October 24, 1950.*

Subject: Bellingham Harbor, Wash.

To: The Chief of Engineers, United States Army.

1. This report is submitted in response to the following resolution adopted August 30, 1944:

*Resolved by the Committee on Rivers and Harbors of the House of Representatives, United States, That the Board of Engineers for Rivers and Harbors created under section 3 of the River and Harbor Act, approved 13 June 1902, be, and is hereby, requested to review the reports on Bellingham Harbor, Washington, submitted in House Document Numbered 1161, Sixtieth Congress, second session, and subsequent reports, with a view to determining if it is advisable to modify the existing project in any way at this time.*

2. Bellingham, Wash., is on the northeasterly shore of Bellingham Bay, about 90 miles north of Seattle. From the northerly extremity of the harbor along the city front the bay extends south about 12 miles to waters connecting with Georgia Strait. Natural deep water extends close to shore at Bellingham except in the northeasterly section of the harbor. The mean range of tides is 5.2 feet and the estimated extreme range is 16 feet. Three waterways have been dredged at the north end of the harbor extending from deep water northeasterly to the shore. The easterly of these is Whatcom Creek waterway which provides access to the municipal dock where a large part of the port commerce is handled. Adjacent to this waterway and the dock local interests maintain a moorage area for about 50 small boats. This is regarded as a temporary arrangement as the space is needed for expansion of the terminal facilities. The I and J Street waterway, about 2,000 feet northwest of Whatcom Creek waterway, is a channel 18 feet deep dredged by the United States Navy to its wharf. About 4,000 feet farther northwest is Squalicum Creek waterway where local interests have provided a basin about 590 feet wide and 1,500 feet long extending shoreward from the United States pierhead line. Finger piers and floats at the inner end of this basin provide temporary moorage for 50 small boats. This moorage restricts access to adjacent boat repair and service facilities. In 1934, with the aid of Federal funds, the port commission constructed a rock breakwater 1,400 feet long extending east from the outer end of the basin at Squalicum Creek waterway. Several years later, local interests constructed pile breakwaters at each end of the rock structure. Between the rock breakwater and a bulkheaded fill to the

shoreward the port of Bellingham maintains a small-boat basin 12 feet deep which is sufficient for accommodation of 180 boats without congestion. While originally intended for commercial fishing boats, it is now used also by recreational craft and is overcrowded. Local interests have initiated enlargement of this basin to extend it south-eastward. The work accomplished consists of construction of 1,360 feet of bulkhead along the shoreward, or easterly, end of the additional area, placement of 60,000 tons of rock which forms the nucleus of a breakwater along the southeast side, and dredging a portion of the area to a depth of 12 feet. Prior to 1947 the port of Bellingham also maintained a small-boat basin in a cove to the south of the Whatcom Creek waterway. In view of the excessive cost of maintaining the timberpile breakwater there and the need of the space by adjacent industries, this basin has been abandoned as a haven for small boats. The existing Federal project for Bellingham Harbor, completed in 1931, provides for depths of 26 feet in the outer 3,800 feet of Whatcom Creek waterway and of 18 feet in the inner 1,300 feet; dredging an entrance channel 200 feet wide and 26 feet deep from deep water to the west end of Squalicum Creek basin; maintenance of the southerly half and westerly end of Squalicum Creek basin to depth of 26 feet; and maintenance of the breakwater constructed by local interests in 1934. Costs to the United States for the existing project to June 30, 1949, were \$112,013 for new work and \$90,179 for maintenance.

3. The area commercially tributary to Bellingham Harbor, embracing most of Whatcom County, had a population of 58,315 in 1940. The estimated population of the city of Bellingham was 32,700 in 1948. Manufacture of forest products, agriculture, commercial fishing, and recreational pursuits are among the important activities of the region. Rail, highway, and air services are available. Commerce of the harbor for the 10-year period 1940 through 1949 averaged 1,026,030 tons annually of which 361,250 tons was vessel commerce and 664,780 tons was rafted logs. Vessel traffic in 1949 consisted of 12,848 in-bound and out-bound trips of which 12,466 were by vessels with drafts of less than 12 feet. From 1938 to 1949 the number of locally based commercial fishing boats increased from 21 to 120 and locally based recreational craft increased from 60 to 202. The nearby waters are popular for commercial fishing, sports fishing, and cruising. As a result, transient small craft frequently visit Bellingham Harbor or seek shelter there during storms.

4. Local interests desire Federal participation in completing the expansion of the existing moorage basin southeasterly of Squalicum Creek waterway so as to suitably accommodate a minimum of 300 commercial fishing vessels and 700 recreational craft. They point out that existing moorage areas are inadequate and claim that the desired improvement would result in substantial benefits in connection with the fishing industry and recreational boating including reduction in boat damages. The improvement will also permit abandonment of the small-boat moorage facilities at the inshore end of Squalicum Creek waterway and on Whatcom Creek waterway so that the spaces occupied may be used for other purposes to improve the efficiency of the port. Local interests offer to furnish rights-of-way for the proposed work, complete the dredging required to provide a

depth of 12 feet in the basin area, maintain this depth, construct any necessary additional bulkheads, and provide a public wharf, moorage facilities, utilities, roads, and parking area.

5. The district engineer states that storm waves are a hazard to small boats moored in unprotected locations in Bellingham Harbor and that suitable moorage space is insufficient to meet the needs of the commercial fishing fleet, locally based recreational boats, and transient small craft. He finds that the most practicable means of securing the needed moorage space for small boats at the harbor is to complete the basin expansion southeasterly of, and adjacent to, Squalicum Creek waterway initiated by local interests. His plan for this purpose contemplates a basin area, as enlarged, of about 46.7 acres with minimum depth of 12 feet bounded to shoreward by the existing bulkheads and extending seaward to a rock breakwater to be constructed generally along the United States pierhead line. Where the basin borders the Squalicum Creek waterway it would be protected by a shoreward extension of the breakwater leaving an entrance 100 feet wide between the breakwater and existing bulkhead. Protection at the southeasterly end of the basin would be afforded by construction of a separate rock breakwater consisting in part of the rock core recently placed by local interests. At the seaward end of this structure an entrance channel 150 feet wide would be maintained to a depth of 12 feet. It is planned that the existing rock breakwater constructed by local interests in 1934, which extends into the basin area, will be removed and the rock therefrom used in constructing the new breakwaters. The district engineer estimates the construction cost to the United States at \$1,224,300 for removal of the existing breakwater and construction of the two sections of new breakwater, 2,025 and 1,875 feet long, and at \$21,860 for establishing navigation aids, a total of \$1,246,160. He estimates the first cost to local interests at \$454,080 for removing existing piling; dredging to secure the minimum depth of 12 feet; and establishing dolphins at the outer entrance, mooring facilities, terminal facilities; and utilities. The total estimated first cost is thus \$1,700,240. The district engineer estimates the Federal annual carrying charges at \$62,930 which includes \$13,500 for maintenance in addition to the amount now required. The district engineer estimates the net non-Federal annual carrying charges at \$15,450, including the cost of dredging to maintain depths of 12 feet in the basin. The estimated annual carrying charges total \$78,380.

6. Prospective annual benefits of the planned improvement as evaluated by the district engineer include \$47,400 for elimination of vessel damages and losses, and expenses which will otherwise be incurred in precautionary measures to keep such damages and losses at a minimum; \$62,600 for the net value of the increased catch of fish resulting from elimination of harbor delays for commercial fishing vessels and from enabling vessels now based at ports more distant from the fishing grounds to use Bellingham Harbor as a base with resulting reduction in the nonproductive time consumed in their operations; and \$18,480 for additional recreational boating values. These estimated benefits total \$128,480. The benefit-cost ratio is 1.64.

7. The district engineer recommends modification of the existing project to provide for a small-boat harbor in accordance with his described plan, provided that local interests furnish satisfactory assurances that they will, without cost to the United States, furnish



necessary rights-of-way and spoil-disposal areas, including the right to remove and use rock from the previously constructed breakwater, and title to the portion of the proposed breakwater already constructed by local interests; hold the United States free from property damages that may result; remove the timber-pile breakwaters; complete the dredging required to deepen the basin to 12 feet, and maintain that depth; provide and maintain any bulkheads required to retain dredged material; construct required dolphins at the ends of the breakwater; construct in accordance with approved plans, maintain, and operate without profit, adequate moorage facilities, utilities, and a public landing with suitable services and supplies open to all on equal and reasonable terms. The division engineer concurs.

8. Local interests were informed of the recommendations of the reporting officers and given an opportunity to present additional information to the Board. On October 24, 1950, the Board held a hearing at which an official of the port of Bellingham stressed the need for additional, protected, mooring space to accommodate commercial fishing boats and recreational craft, expressed approval of the plan for further improvement, and indicated that local interests will meet the requirements of cooperation.

#### VIEWS AND RECOMMENDATIONS OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS

9. The Board of Engineers for Rivers and Harbors concurs in the finding of the reporting officers that available moorage areas for fishing boats and recreational craft at Bellingham Harbor are insufficient to meet the needs of existing and prospective commerce. The district engineer presents a suitable plan for remedying this situation by completing the enlargement of the small-boat basin, adjacent to Squalicum Creek waterway, which has been initiated and partially accomplished by local interests at considerable expense to themselves. He proposes appropriate conditions of local cooperation. The prospective benefits economically justify the estimated expenditures required for the proposed work.

10. Accordingly, the Board recommends modification of the existing project for Bellingham Harbor, Wash., to provide for a small-boat basin adjacent to Squalicum Creek waterway, the Federal work to consist of construction and maintenance of two sections of rubble-mound breakwater with combined length of about 3,900 feet, removal of the existing rubble-mound breakwater now included for maintenance in the existing project and use of the rock therefrom in construction of the new breakwater, and maintenance of minimum depths of 12 feet in the entrances to the basin, generally in accordance with the plan of the district engineer and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable; at an estimated cost to the United States of \$1,224,300 for new work and \$13,500 annually for maintenance in addition to that now required; provided local interests agree to (a) furnish without cost to the United States all lands, easements, rights-of-way, and suitable spoil-disposal areas for the new work and for subsequent maintenance, when and as required, including title to the portion of the proposed breakwater already constructed by local interests and including the right to remove rock from the previously constructed project breakwater for

use in the proposed Federal work; (b) hold and save the United States free from damages due to construction and maintenance of the improvement; (c) remove the timber-pile portions of the existing breakwater, perform all dredging required to provide and maintain in the basin a depth of 12 feet at mean lower low water; (d) construct protective dolphins at the ends of the breakwaters when and as required; and (e) provide, maintain, and operate adequate moorage facilities, utilities, and a public landing with suitable service and supply facilities open to all on equal terms.

For the Board:

J. S. BRAGDON,  
*Major General, Chairman.*

## REPORT OF THE DISTRICT ENGINEER

### SYLLABUS

The district engineer reports that increasing small-boat activities and lack of adequate moorage facilities in Bellingham Harbor necessitate enlargement of the present small-boat basin southeasterly of Squalicum Creek waterway and that general benefits therefrom are sufficient to warrant Federal participation in the improvement. He accordingly recommends that the existing navigation project for Bellingham Harbor be modified to provide for removal of the existing rubble-mound breakwater southeasterly of Squalicum Creek waterway and the construction of a new rubble-mound breakwater seaward of the existing one and in two sections, totaling 3,900 feet in length, as shown on the accompanying map, at an estimated Corps of Engineers first cost of \$1,224,300 and \$13,500 for annual maintenance above that now required, subject to certain conditions of local cooperation as outlined in the report.

CORPS OF ENGINEERS, UNITED STATES ARMY,  
OFFICE OF THE DISTRICT ENGINEER,  
SEATTLE DISTRICT,  
*Seattle 4, Wash., May 17, 1949.*

Subject: Review of reports on Bellingham Harbor, Wash.

To: The Division Engineer, North Pacific Division, Corps of Engineers, Portland 5, Oreg.

1. *Authority.*—This report is submitted in compliance with a resolution adopted August 30, 1944, by the Committee on Rivers and Harbors of the House of Representatives which reads as follows:

*Resolved by the Committee on Rivers and Harbors of the House of Representatives, United States, That the Board of Engineers for Rivers and Harbors created under section 3 of the Rivers and Harbors Act approved June 13, 1902, be, and is hereby, requested to review the reports on Bellingham Harbor submitted in House Document Numbered 1161, Sixtieth Congress, second session, and subsequent reports, with a view to determining if it is advisable to modify the existing project in any way at this time.*

2. *Scope of review.*—A review of survey scope was authorized by the Chief of Engineers on February 16, 1945. The report studies are based on data available in published documents and in the files of this office, on information furnished by local interests, and on topographic and hydrographic surveys of Bellingham Harbor conducted by this office and the port of Bellingham during 1946 and 1948. During the course of the investigation interested local, port, city, county, State, and Federal agencies were consulted. Their requests, comments, and suggestions have been given full consideration in the studies.

3. This report reviews House Document No. 1161, Sixtieth Congress, second session, and subsequent reports listed in table 1, particularly House Document No. 187, Seventieth Congress, first session, and House Committee on Rivers and Harbors Document No. 70, Seventy-fourth Congress, first session.

TABLE 1.—*Prior reports under review*

Document number and date of report	Authority and type of report	Recommendation of Chief of Engineers congressional action
H. Doc. No. 1161, 60th Cong., 2d sess., Dec. 9, 1908. <sup>1</sup>	River and Harbor Act, Mar. 2, 1907, preliminary examination and survey.	Favorable to dredging Whatcom Creek waterway to depth of 26 feet in outer part, 18 feet in inner part; subject to local cooperation. Adopted by River and Harbor Act, June 25, 1910.
Not published; Mar. 10, 1924. <sup>2</sup>	River and Harbor Act, Sept. 22, 1922, preliminary examination.	Unfavorable for survey with a view to deepening Whatcom Creek waterway, and providing turning basin.
Not published; Dec. 11, 1925. <sup>2</sup>	River and Harbor Act, Mar. 3, 1925, preliminary examination.	Unfavorable for survey with a view to removing Starr Rock.
H. Doc. No. 187, 70th Cong., 1st sess., Feb. 24, 1928. <sup>1</sup>	River and Harbor Act, Jan. 21, 1927, preliminary examination and survey.	Favorable for a channel 26 feet deep, 200 feet wide from deep water to pier-head line in Squalicum Creek waterway. Subject to local cooperation. Adopted by River and Harbor Act, July 3, 1930.
Not published; May 4, 1932. <sup>2</sup>	River and Harbor Act, July 3, 1930, preliminary examination.	Unfavorable for a survey with a view to diverting Nooksack River from the harbor, and to construction of a breakwater.
House Committee on Rivers and Harbors Doc. No. 70, 74th Cong., 1st sess., July 26, 1935. <sup>1</sup>	Resolution, House Committee on Rivers and Harbors, Jan. 29, 1934, review of reports.	Favorable for maintenance of southerly half and westerly end of Squalicum Creek basin to 26-foot depth, and for maintenance of existing breakwater to 14-foot height. Adopted by River and Harbor Act of Aug. 26, 1937.

<sup>1</sup> Date of transmittal to Congress.

<sup>2</sup> Date of Chief of Engineers report.

4. *Description*.—Bellingham Harbor is in the northwestern part of the State of Washington, at approximate latitude 48°45' north and longitude 122°30' west. It is situated along the easterly shore of Bellingham Bay, about 80 nautical miles north of Seattle and about 40 nautical miles southeast of Blaine as measured by ordinary steamer route. Bellingham Bay is about 12 miles long and 3 miles wide. It is bounded by the mainland on the east and north, and by a low, sandy peninsula and Lummi Island on the northwest and west. The bay is open to the south and southwest. Cypress, Guemes, and other islands located off the bay entrance provide considerable protection against the open waters of Rosario Strait. The easterly shore of Bellingham Bay is indented by Chuckanut Bay, a deep-water cove located about 5 miles south of the main part of Bellingham Harbor. Samish Bay constitutes the southeasterly part of Bellingham Bay.

5. Bellingham Harbor has a deep-water approach ranging from about 16 fathoms in the outer part to 4 fathoms near shore except in the northeasterly portion where tidal flats extend about one-fourth to one-half mile from shore and the bottom slopes gradually to deep water. Three waterways extend across these tidal flats, namely Squalicum Creek, I and J Street, and Whatcom Creek waterways. These waterways were originally established by the State of Washington. Squalicum Creek and Whatcom Creek waterways have been improved under a Federal project to accommodate deep-water traffic.

I and J Street waterway has been partially dredged by the United States Navy and local interests. A Federal pierhead line has been established.

6. Bellingham channel, lying between Cypress and Guemes Islands, is generally used by ships proceeding to Bellingham Bay from Strait of Juan de Fuca and from the southward. The channel varies from 17 to 60 fathoms in depth and from one-half to 1½ miles in width. Light-draft vessels also frequently approach the bay from the south by way of Swinomish Slough and Padilla Bay. Deep-draft vessels approaching Bellingham Bay from the northward use the channel between Lummi and Sinclair Islands. This channel has a minimum depth of 30 fathoms and a minimum width of 1,200 yards. Hale Passage, lying between Lummi Island and the mainland, is frequently used by light-draft vessels approaching from the northward. This passage, connecting Bellingham Bay with the Straits of Georgia, is about 6 miles long and about three-fourths mile wide. Its depth varies from 15 feet at the northwestern end to 60 feet at the southeastern end. Bellingham Bay and its approaches are shown on United States Coast and Geodetic Charts Nos. 6378, 6380, and 6300, and the maps accompanying this report.

7. *Tides and currents.*—The mean range of tides in Bellingham Harbor is 5.2 feet, the diurnal range is 8.6 feet, and the estimated extreme range is 16.0 feet. Tidal currents in the harbor and bay have little velocity and do not interfere with navigation. Their general direction is north and south. With respect to currents in the approaches to Bellingham Bay, the United States Coast Pilot, Pacific Coast, sixth edition, states, "between Cypress and Guemes and Sinclair Islands the tidal currents have considerable velocity, but between Sinclair and Vendovi Islands the current is considerably less."

8. *Climate.*—The climate of the locality is mild and equitable. Records of observations near Bellingham over a period of 35 years show a maximum temperature of 97°, a minimum of -4°, and a mean of 48.9°. Extreme temperatures are rare and of short duration as indicated by an average minimum temperature of 29° for January, the coldest month, and an average maximum temperature of 74.2° for August, the warmest month. The mean annual precipitation is 33.67 inches and the average snowfall 9.6 inches. Bellingham Harbor and approaches are ice-free throughout the year. The prevailing winds are from the west and southwest during the spring, summer, and autumn months and from the southeast during winter months. Fogs may occur at any time of the year but are most frequent during the spring and autumn months.

9. *Tributary area.*—The area tributary to Bellingham Harbor includes all of Whatcom County except Point Roberts and the city of Blaine and its environs. The topography of Whatcom County varies from rich tidal plains along the east shore of Bellingham Bay and the valley of the Nooksack River in the western portion to the mountainous areas comprising the eastern portion.

10. *National and departmental reservations.*—The Lummi Indian Reservation, with an area of about 20 square miles, includes all of the peninsula west of Bellingham Bay and a portion of the mainland adjacent thereto. Some 1,300 square miles of the eastern part of the tributary area is in the Mount Baker National Forest.



11. *Cities*.—Bellingham, situated on the northeasterly shore of the bay, is the seat of the county government and the principal outlet for the water-borne commerce of the tributary area. In 1940 the city had a population of 29,314, a decrease of 1,509 from 1930. The State census board, however, estimated the population at 32,700 in 1948. Bellingham is a port of entry with United States Customs and Immigration Service offices located therein. Other incorporated cities and towns in the tributary area are Everson, Ferndale, Lynden, Nooksack, and Sumas, all of which are located inland. These communities are dependent upon the agricultural, logging, or mining operations in their immediate vicinities. Distribution and trend of population are given in table 2 adapted from the Federal census for the earlier years and estimates of the Washington State Census Board for 1948.

TABLE 2.—*Distribution of population, area tributary to Bellingham Harbor*

Locality	Population			
	1920	1930	1940	1948 <sup>1</sup>
Bellingham (city).....	25,585	30,823	29,314	32,700
Everson (town).....	(?)	295	292	314
Ferndale (town).....	759	752	717	850
Lynden (town).....	1,244	1,564	1,696	2,358
Nooksack (town).....	283	293	302	298
Sumas (city).....	854	647	650	670
Remainder of tributary area.....	19,150	22,646	25,344	(?)
Total, tributary area.....	47,875	57,020	58,315	(?)

<sup>1</sup> State census board estimate.

<sup>2</sup> Not available.

12. The population statistics reflect a slow over-all growth. The increase since 1940, particularly in Bellingham, is believed to have resulted from the wartime increase in industrial activity. Future growth will depend largely on development of new industries and resources other than forest products.

13. *Resources and industries*.—The principal resources of the tributary area are its forests, agricultural lands, fisheries, mineral deposits, and natural recreational features. Past industrial development centered chiefly on forest resources. In recent years agriculture, fishing, and the processing of their products have become increasingly important.

14. *Forest resources and industries*.—Statistics compiled by the Pacific Northwest Forest and Range Experiment Station, United States Forest Service, as of September 1941 showed the total volume of merchantable timber resources in Whatcom County to be approximately 9 billion board feet. Of this total roughly two-thirds was on timberlands in Federal, State, or county ownership. Approximately one-third of this publicly owned timber was reserved from cutting. Statistics compiled by the same agency as of January 1943 show the total volume of saw timber on the unreserved lands of Whatcom County to be approximately 7 billion board feet. An estimated distribution of the saw timber on the unreserved lands is given by species in table 3.

TABLE 3.—*Saw timber on unreserved lands of Whatcom County, Jan. 1, 1943*

Species:	Volume (thousand board feet)
Douglas fir .....	2, 010, 000
Sitka spruce .....	5, 000
Western hemlock .....	2, 434, 000
Western red cedar .....	983, 000
Balsam fir .....	1, 551, 000
Other conifers .....	95, 000
Hardwoods .....	96, 000
Total .....	7, 174, 000

15. In 1943 the current annual growth on trees 15.1 inches or more in diameter was estimated to exceed 41 million feet board measure and on trees 5.1 inches or more, the current annual growth was estimated to exceed 20 million cubic feet. During the last two decades large quantities of sawlogs have been imported by rail from Skagit County and by water from British Columbia and from Clallam County on the Olympic Peninsula.

16. The manufacture of forest products is one of the principal industries of the tributary area. In earlier years the industry centered chiefly on manufacture of lumber from the Douglas fir species. In more recent years the use of pulpwood species has become increasingly important. In 1945 15 mills produced approximately 73 million feet of lumber, board measure. In addition to the sawmills, a pulp mill of about 360 tons daily capacity, a paper mill of 40 tons daily capacity, a plywood plant, several shingle mills, door and furniture factories, and other wood-using plants are located in the tributary area. A distillery located at Bellingham produces approximately 5,000 gallons of alcohol daily from forest products. It is reported that the capacity of the plant is to be doubled. The Federal census of 1940 showed the value of all products manufactured in 111 establishments employing approximately 2,600 persons in Whatcom County as about \$16,000,000, the bulk of which emanated directly or indirectly from forest resources.

17. *Agriculture.*—About 15 percent of the land in Whatcom County was used for agricultural purposes in 1945. This land, valued at approximately \$35,000,000 including improvements, is largely confined to the Nooksack Basin in the western portion of the county. The census of agriculture for 1945 enumerated 4,845 farms in the county with a total acreage of 206,781, of which about 71,500 acres were in crops. The value of farm products sold was approximately \$14,240,000, approximately 83 percent of which represented livestock and livestock products, mainly dairy and poultry products. Other farm products included forage crops, grain, fruits, nuts, and vegetables. The farm population in 1945 was 17,883, and the number of persons employed on farms was 6,830.

18. *Fisheries.*—Bellingham Harbor is particularly well situated with respect to the fishing banks of Rosario and Georgia Straits, Bellingham Bay, Hale Passage, and the waters of the San Juan Archipelago. It is near the inside water route to Alaska, and is one of the United States ports to which large quantities of fish are transported from southeastern Alaska for processing and distribution. The Pacific American Fisheries, a corporation whose fishing operations are carried on mainly in Alaska waters, has its headquarters, supply, service, and repair facilities at Bellingham. Three canneries,

a cold storage plant, and several receiving stations are situated at Bellingham for receipt, processing, storage, and distribution of fish caught in local waters. Records maintained by the processing plants and receiving stations show that 7,018 tons of locally caught fish and shellfish, having a value of about \$2,161,000 at the fishermen's price level, were landed at Bellingham in 1947. A survey conducted by local interests indicated that fishing and allied industries (such as the fish processing and distribution industries, and marine supply, repair, and servicing businesses) had a total value of \$5,675,000 in 1947. Because of its advantageous location with respect to the fishing banks and because of availability of icing facilities, marine repair, service and supply facilities, Bellingham has become increasingly important as a base for a large number of local and transient boats. The number of locally based fishing boats is estimated to be 120, consisting of 60 purse seiners, 30 beam trawlers, and 30 trollers and gill-netters. These have a total value of about \$2,000,000 and employ about 630 fishermen. The species of fish landed at Bellingham include salmon, halibut, true cod, ling cod, rockfish, sable fish, sole, sturgeon, crabs, and clams.

19. *Recreation.*—The area tributary to Bellingham Harbor has many natural recreation features. The waters surrounding the San Juan Islands attract pleasure craft from all parts of Puget Sound and the coastal areas of British Columbia. At present, about 202 pleasure craft, representing an investment of about \$1,010,000, are based in Bellingham Harbor. Many summer homes, beach resorts, and sports-fishing facilities are found on the islands and on the shores of the mainland adjacent to Bellingham and Chuckanut Bays. Bellingham Bay, Hale Passage, Rosario Straits, and the Straits of Georgia are favorite spots for salt water sport fishing. Local interests estimate that approximately 143,000 pounds of food fish (mostly troll-caught salmon) were taken in these waters by salt water sports fishermen during 1948. Based on the average price received by commercial fishermen for salmon (which commands a high price), the value of this catch would be about \$37,400. Local interests assert that the amount of food fish taken by sports fishermen would be doubled if sufficient moorage facilities were available to accommodate all pleasure and sports-fishing craft seeking use of the harbor. Snowcapped Mount Baker, reaching an elevation of 10,750 feet, and located in the central part of Whatcom County, is accessible by highway. It is one of the most popular winter sports playgrounds and summer recreational areas of the Pacific Northwest. Many campgrounds, fishing streams, and game-hunting areas are available in the mountainous areas of the county. Numerous lakes, accessible by highway, are suitable for boating, fishing, swimming, and summer homes. The lowlands adjacent to Bellingham and Samish Bays are popular spots for waterfowl hunting. In addition to the vast recreational area in Mount Baker National Forest, the tributary area contains a State park and 23 city parks.

20. *Minerals.*—The tributary area has extensive mineral resources, both developed and undeveloped. Whatcom County has a number of coal mines, among them the largest one in the State. The production of these mines averages approximately 225,000 tons annually. The coal deposits are believed sufficient to retain this rate of production for many years. Considerable deposits of limestone occur throughout the county. A limestone quarry about 20 miles east of Bellingham supplies a large cement plant in that city. Clay, molding sand, sand,

gravel, and stone deposits occur in large quantities and are used extensively. Other nonmetallic minerals found in the locality include amphibole asbestos, diatomite, graphite, marble, mineral pigments, mineral waters, olivine, natural gas, peat, silica, and strontium. A number of metallic minerals also exist in the area of which gold, silver, lead, and copper are mined on a small scale.

21. *Railroads*.—A coastal line of the Great Northern Railway extends from the main line at Everett, Wash., to Vancouver, British Columbia, passing through Bellingham. It provides daily passenger and freight service. The Northern Pacific Railway and the Chicago, Milwaukee, St. Paul & Pacific Railroad have branch lines to Bellingham.

22. *Highways*.—Federal and State highways with local feeder roads provide access to most parts of the tributary area except the mountainous eastern part. The Pacific Highway (U. S. No. 99 and State No. 1) extends along the coast through Bellingham. A branch of State Highway No. 1 extends from Bellingham to Mount Baker. Local feeder roads connect with these highways throughout the settled western part of the tributary area. Regular car and passenger ferry service is available between Bellingham and the San Juan Islands.

23. *Air transportation*.—Bellingham Airport, about 2 miles north of the city, provides adequate facilities for commercial airlines. The West Coast and United Airlines provide direct and interconnected daily service to all parts of the United States, Canada, and Alaska.

24. *Adjacent ports*.—Blaine Harbor is situated about 40 nautical miles north of Bellingham, just south of the international boundary between United States and Canada. The city of Blaine and the small cannery village of Semiahmoo, with a combined population of 1,730 in 1940, are adjacent to that harbor. The commerce of Blaine Harbor, amounting in volume to about 3 percent of that for Bellingham Harbor over the past 10 years, consists chiefly of rafted logs and fresh and canned fish.

25. Anacortes Harbor is on the northern point of Fidalgo Island, about 16 nautical miles south of Bellingham by the most direct route, and 18 nautical miles by ordinary steamer route. The city of Anacortes, with an estimated population of 7,200 as of April 1948, is on that harbor. The commerce of Anacortes Harbor, amounting in volume to about 55 percent of that for Bellingham Harbor over the past 10 years, consists chiefly of rafted logs, petroleum products, fresh and canned fish, wood pulp, and canned vegetables.

26. Everett Harbor on Port Gardner Bay is about 62 nautical miles south of Bellingham. The city of Everett, with an estimated population of 35,000 as of April 1948, is adjacent to that harbor. The commerce of Everett Harbor averages about four times the volume for Bellingham Harbor, and consists principally of rafted logs, petroleum products, lumber, sand, gravel, stone, wood pulp, and fresh and canned fish.

27. *Bridges*.—A fixed timber trestle was constructed by the Great Northern Railway across the head of Chuckanut Bay in 1902. All but 210 feet of the trestle was replaced with a fill in 1920. This structure is about 4 miles south of the railway station in Bellingham and lies between the shore and the established pierhead line. The trestle has a maximum horizontal clearance of 16 feet between bents and a vertical clearance of 14.6 feet at mean lower low water and 6.0



feet at mean higher high water. The trestle and fill were constructed without Department of the Army permit. The trestle was constructed prior to establishment of pierhead lines.

28. *Prior reports.*—In addition to the reports listed in table 1, the following reports relating to navigation on Bellingham Bay have been prepared and submitted by the Corps of Engineers.

29. A report on a preliminary examination of Bellingham Bay, published in House Document No. 228, Fifty-third Congress, third session, was favorable for a survey to determine the advisability of removing Starr Rock as a menace to navigation. The River and Harbor Act of March 3, 1905, authorized a survey of Starr Rock. Because of excessive cost, removal was not recommended (Annual Report of Chief of Engineers for 1906, p. 2026).

30. House Document No. 80, Fifty-fifth Congress, first session, contained a report on a survey of Bellingham Bay recommending dredging of Whatcom Creek waterway to a depth of 12 feet at mean lower low water. This improvement was adopted by the River and Harbor Act of June 13, 1902.

31. *Existing Corps of Engineers project.*—The original project, adopted by River and Harbor Act of June 13, 1902, provided for dredging of Whatcom Creek waterway to a depth of 12 feet at mean lower low water over a width of 200 feet from deep water to the then existing railroad bridge and thence over the full width of the waterway to its inner end. Cost and expenditures on this project, prior to adoption of the existing project in 1910, were \$56,581.93 for new work and \$1,092.05 for maintenance, a total of \$57,673.98.

32. The existing project as defined and modified by the River and Harbor Acts of June 25, 1910, July 3, 1930, and August 26, 1937, and described in House Document No. 1161, Sixtieth Congress, second session; House Document No. 187, Seventieth Congress, first session; and Rivers and Harbors Committee Document No. 70, Seventy-fourth Congress, first session, provides for (a) dredging and maintaining the outer 3,800 feet of Whatcom Creek waterway (363.2 feet wide) to a depth of 26 feet at mean lower low water and the inner 1,300 feet to a depth of 18 feet; (b) dredging and maintaining a channel in Squalicum Creek waterway 200 feet wide and 26 feet deep from deep water in the bay to the main pierhead line; (c) maintenance of the southerly half and westerly end of Squalicum Creek Basin to a depth of 26 feet at mean lower low water provided that no dredging be done within 75 feet of wharves, piers, or similar structures; and (d) maintenance of the existing breakwater to a crest height of 14 feet. Dredging of Whatcom Creek waterway was completed in 1913. Dredging of the outer channel in Squalicum Creek waterway was completed in 1931.

33. The costs of the existing project to June 30, 1948, have been \$112,013.16 for new work and \$69,826.32 for maintenance, a total of \$181,839.48. The latest approved estimate of annual maintenance is \$2,000 (1928) for Whatcom Creek waterway, and \$2,500 (1937) for Squalicum Creek waterway. The amount for Squalicum Creek waterway is considered adequate for the present and immediate future, but recent experience indicates that maintenance cost of Whatcom Creek waterway is averaging about \$5,000 annually. Maintenance dredging in Whatcom Creek waterway was done during the 1949 fiscal year.

34. *Existing local cooperation.*—No local cooperation was required in connection with the original project for improvement of Bellingham Harbor. The River and Harbor Act of June 25, 1910, required local interests to furnish the necessary rights-of-way and easements for disposal of the material dredged from Whatcom Creek waterway and to construct the necessary bulkheads and groins. The River and Harbor Act of July 3, 1930, required local interests to dredge and maintain the southerly half and westerly end of that portion of Squalicum Creek waterway lying shoreward of the main pierhead line and to construct a suitable public terminal. All conditions of cooperation were met in full by local interests. The sum of \$155,231.18 was expended by them for dredging. The River and Harbor Act of August 26, 1937, released local interests from the responsibility of maintaining Squalicum Creek waterway. In addition to the required cooperation, the port commission in 1934 constructed, with the aid of Federal relief funds, a rubble-mound breakwater 1,400 feet long southeasterly of Squalicum Creek waterway. The cost of this breakwater was approximately \$139,000 of which the port contributed about \$51,000. It was later incorporated in the Federal project for maintenance but its ownership has thus far remained with the port of Bellingham.

35. *Other improvements.*—Improvements for navigation made by local interests other than those required by the prescribed conditions of cooperation are shown in table 4. All cost for these improvements was borne by the port of Bellingham except the basin southeast of Squalicum Creek waterway for which the city of Bellingham contributed \$100,000. Various local interests have dredged approaches to privately owned wharves, piers, and log storage and sorting areas. The cost and extent of those improvements are not known.

TABLE 4.—*Improvements to navigation in Bellingham Harbor made by the port of Bellingham*

Date	Nature and location of improvement	Expenditure
1937	Dredging in Whatcom Creek waterway and constructing moorage facilities for small boats on easterly side thereof	\$45,800
1937-46	Dredging basin and constructing timber-pile breakwaters and moorage facilities for small boats on southerly shore of Bellingham Bay (this haven has been abandoned)	191,800
1946-47	Dredging and constructing a rock-crib breakwater and moorage facilities for small boats at inner northwesterly end of Squalicum Creek waterway	18,400
1946	Dredging channel and constructing bulkhead along easterly margin of I and J Streets waterway	30,000
1937-48	Constructing extensions to and increasing height of breakwater southeast of Squalicum Creek waterway	87,800
1946-49	Small-boat basin southeast of Squalicum Creek waterway:	
	Rock in new breakwater	\$148,000
	Dredging	105,800
	Bulkheads	53,300
	Floats and terminal facilities	178,750
	Subtotal	485,850
	Total expenditures on completed improvements	859,650

36. *Terminal and transfer facilities.*—There are 23 usable piers and wharves in Bellingham Harbor. These are distributed as follows: one north of Squalicum Creek waterway; five in and adjacent to Squalicum Creek waterway; one in I and J Street waterway; seven in Whatcom Creek waterway; eight along the southern shore of Bell-

ingham Harbor, and one on the eastern shore of Chuckanut Bay. In addition, there are four small-boat moorages and three log dumps (with booming grounds).

37. Four piers and wharves and four small-boat moorages are owned and operated by local governmental agencies. These facilities are open to all on equal and reasonable terms. The municipal dock, located on Whatcom Creek waterway, is owned and operated by the port of Bellingham, and is used for handling general cargo in foreign and domestic trade. This wharf has 1,350 feet of berthing space at depths ranging from 26 to 30 feet at mean lower low water. Transit sheds thereon have 68,000 square feet of storage space. The wharf, transit sheds, and storage areas are constructed on timber piling. A grain elevator, with hopper, and electric conveyor located on the wharf is leased to a private concern and is not available for public use. The freight-handling equipment is considered adequate. The wharf has connections with three railroads, but the railway spur is so located that direct transfer between ship and railway car is not possible. A large part of the commerce of the port passes over this wharf. However, port officials are desirous of developing a new terminal elsewhere because of the high cost of cargo transfer at the present wharf, the high cost of wharf maintenance, and the impracticability of wharf extension.

38. The city of Bellingham owns and operates a wharf at the upper end of Whatcom Creek waterway for local cargo and passenger trade, principally between the mainland and the San Juan Islands. The wharf has 400 feet of frontage with a depth of 16 feet at mean lower low water. No transit sheds, mechanical freight-handling equipment, or railway connections are available.

39. An oil wharf, owned by the port of Bellingham and located in Squalicum Creek waterway, has 310 feet of berthing space at a depth of 26 feet at mean lower low water. The wharf is leased to oil companies for servicing and bunkering small craft. The wharf has no railway connections, but is adequately equipped for the purposes for which it is used. The port of Bellingham also owns and operates a wharf on the inshore end of Squalicum Creek waterway, which is used primarily by concerns engaged in the construction, repair, supply, and servicing of small boats. That wharf is U-shaped and has a frontage of about 450 feet with water averaging about 16 feet in depth at mean lower low water. It has no railway connections but is adequately equipped for its needs. The port has installed floats and finger piers in the basin inclosed by this wharf to provide a temporary moorage for about 50 boats. Port officials plan to remove the moorage facilities as soon as adequate space becomes available elsewhere, in order to provide better access to the wharf and its marine repair facilities.

40. The port of Bellingham maintains a small-boat basin just southeasterly of Squalicum Creek waterway, shoreward of the rubble-mound breakwater. Fueling, servicing, and equipment for handling fish cargoes are available. The basin has facilities for mooring about 180 boats without congestion. Originally developed as a fishing boat moorage, the basin is now used for both fishing and pleasure boats. Consequently, it has become overcrowded and inadequate, and the port has found it necessary to begin its enlargement. Because of limited

local funds, port and other local interests have requested Federal assistance in this work.

41. The port is also presently maintaining a temporary moorage for about 50 boats near the inshore end of the municipal dock on Whatcom Creek waterway. Port officials plan to abandon this moorage as soon as adequate facilities become available in the new basin near Squalicum Creek. The space will then be used for expansion and rearrangement of the port terminal facilities. From about 1937 to 1946, the port of Bellingham maintained a small-boat basin on the south shore of Bellingham Bay (table 4). As a result of a severe storm in January 1947 which partly destroyed the basin, and because of excessive cost of maintaining the timber pile breakwater, the port discontinued maintenance of this basin.

42. The United States Navy has a wharf in connection with a Naval Reserve armory on the southeasterly side of I and J Street waterway. The Navy has dredged a channel about 80 feet wide and 18 feet deep from deep water to the wharf.

43. A private wharf at the head of Whatcom Creek waterway with a frontage of 500 feet at depths from 16 to 23 feet at mean lower low water is open to the public for handling cargo in internal trade. This pier has a transit shed with 12,750 square feet of storage space, but has no railway connection. Of the remaining 18 wharves, all private, 1 is used as a railway car ferry slip, 14 are owned by various industrial and commercial firms, and 3 are launchways at small-boat plants. Ten of these terminals have railway connections and are equipped with adequate transfer facilities.

44. The port of Bellingham has spent about \$574,000 for construction and maintenance of wharves, storage and transfer facilities in addition to the expenditures listed in table 4. The expenditures by private interests are not known. All terminal facilities, except the present municipal dock and the small-boat moorages, are considered adequate for the present and prospective commerce of the harbor. Removal of the small-boat basin adjacent to the municipal dock will allow expansion and rearrangement of the dock to render it adequate and better suited for the handling of general commerce. Additional terminal space is available between Squalicum Creek and I and J Street waterways.

45. *Improvements desired by local interests.*—A public hearing was held at Bellingham, Wash., on April 10, 1946, by the district engineer in connection with this review. The hearing was attended by 70 persons representing Federal, State, and local governmental agencies; the port of Bellingham, fishing and pleasure boat owners; fishing interests; labor, business, and civic organizations, and other general interests. At the hearing local interests requested—

(a) Improvement of I and J Street waterway by dredging a channel, 500 feet wide (including 300 feet shoreward of pierhead lines) and 32 feet deep at mean lower low water, from deep water in Bellingham Bay to a line about 250 feet from the upper end of the waterway; and dredging an area of about 15 acres near the upper end of the waterway to a depth of 15 feet to provide a mooring basin for fishing and pleasure craft.

(b) Replacing with rock the existing pile extensions at each end of the rubble-mound breakwater southeast of Squalicum Creek waterway and including maintenance of the extensions in the Federal project.



(c) Construction of a mooring basin in Chuckanut Bay for fishing vessels and pleasure craft by dredging, to a depth of 15 feet at mean lower low water, an area of approximately 30 acres lying shoreward of the Great Northern Railway trestle and embankment.

46. The reasons advanced by local interests in justification of the improvements included—

(a) Need for development of additional public terminal facilities, industrial sites, and service and repair facilities.

(b) Lack of protected moorage and service facilities for locally based and transient fishing vessels and pleasure craft.

(c) Existing moorages are scattered, of a temporary nature, and unsuited for enlargement or provision of adequate protection and moorage or service facilities.

(d) Vessels in existing moorages or seeking shelter have suffered extensive damages during storms because of inadequate protection.

(e) Need of moorage facilities for Coast Guard vessels and other small vessels which might be required for defense in case of a national emergency.

47. Local interests offered to cooperate in the desired improvements to the extent of providing the necessary land, easements, and rights-of-way; constructing all bulkheads required for retention of the dredged material; and constructing, maintaining, and operating adequate moorage facilities.

48. The necessity for two additional small-boat basins in Bellingham Harbor was not disclosed at the hearing. The evidence presented indicated that local interests were not in full agreement on either of the two sites selected for a small-boat harbor. Statements made at the hearing disclosed that provision of an opening through the Great Northern Railway trestle across the head of Chuckanut Bay would be necessary for development of the site selected by local interests. In a statement submitted after the hearing, the railway company objected to the development of a small-boat harbor shoreward of the railway embankment and trestle, stating that the installation of a drawbridge would (1) create a hazard to safe train operation because of its proximity to a railway tunnel just west of the site; (2) cause inevitable delays to rail traffic; and (3) result in additional expense to the railway company.

49. In view of objections by the railway company to the Chuckanut Bay proposal and of pleasure-boat interests to the proposed boat basin in I and J Street waterway, local interests decided, at a meeting in Bellingham on June 24, 1947, to withdraw their original requests for these improvements and to request instead the development of a basin on the westerly shore of Chuckanut Bay, just south of the Great Northern Railway, suitable for both fishing and pleasure craft. This plan involved no dredging but did require provision of a breakwater for which they suggested a location off the west shore about 1,800 feet south of the railway. Local interests offered the usual cooperation in the development of this basin. Subsequent investigations and studies revealed, however, that local interests were not in agreement on this site, and that the fishing interests were not desirous of transferring their base of operations from Bellingham Harbor to Chuckanut Bay. Surveys of the site showed excessive depths of water, and extremely unstable bottom material, which would have resulted in high construction costs that could not be economically justified.

50. In consequence of these findings, the port commission, city of Bellingham, and all pertinent local interests reconsidered all possible sites in Bellingham Harbor and adjacent areas and unanimously agreed to extension of the existing basin near Squalicum Creek waterway as the best solution to their problem of providing needed moorage for small boats. They also formally withdrew their request for a deep-water channel in I and J Street waterway.

51. Consequently, local interests now desire Federal assistance in extending the small-boat harbor adjacent to Squalicum Creek waterway to provide for a minimum of 300 fishing vessels and 700 pleasure craft. In addition to bulkhead and breakwater construction, dredging and other work already done by local interests at the site, they have offered to (a) furnish all land, rights-of-way, and easements required for construction, maintenance, and operation of the desired extension; (b) perform all remaining dredging required to complete the basin to a depth of 12 feet at mean lower low water and maintain this depth; (c) construct any additional bulkheads that may be required for retention of the dredged material; and (d) construct and maintain a public wharf, floats, and other moorage facilities, utilities, roads, and parking areas. In support of this request, local interests assert that the desired improvement will provide annual benefits totaling \$176,000, by (a) eliminating physical damage to small boats amounting to about \$36,000; (b) reducing operating expenses of small boats an estimated \$47,100; (c) increasing the net earnings of the fishermen about \$72,900; and (d) creating indirect benefits of approximately \$20,000.

52. *Commerce.*—The annual water-borne traffic in Bellingham Bay and Harbor for the years 1927 to 1946, inclusive, is shown in table 5.

TABLE 5.—*Water-borne traffic, Bellingham Bay and Harbor, 1927–46*

Year	Vessel traffic (tons)	Rafted (tons)	Total (tons)	Passengers	Additional traffic, car ferry (tons)
1927	6'6, 181	1, 064, 489	1, 670, 670	122, 945	121, 640
1928	875, 810	1, 452, 132	2, 327, 942	96, 263	209, 000
1929	548, 136	1, 646, 037	2, 194, 173	39, 371	148, 750
1930	582, 3'8	1, 245, 859	1, 837, 167	40, 931	95, 929
1931	446, 389	679, 558	1, 125, 947	54, 260	91, 001
1932	309, 424	319, 763	629, 187	70, 300	63, 875
1933	417, 063	841, 445	1, 258, 508	28, 382	103, 200
1934	340, 082	781, 765	1, 121, 847	24, 290	81, 300
1935	392, 237	775, 886	1, 168, 123	24, 178	91, 560
1936	447, 579	643, 741	1, 091, 320	3, 614	117, 570
1937	461, 554	554, 180	1, 015, 734	12, 013	116, 460
1938	317, 620	282, 279	599, 899	14, 131	96, 960
1939	322, 943	476, 213	799, 156	8, 538	91, 800
1940	343, 300	587, 448	930, 748	8, 412	106, 320
1941	310, 604	1, 247, 543	1, 558, 147	3, 685	167, 630
1942	276, 228	884, 878	1, 161, 106	7, 078	26, 280
1943	259, 168	686, 255	945, 423	9, 312	420
1944	261, 430	699, 485	960, 915	8, 500	( <sup>1</sup> )
1945	275, 295	418, 460	693, 755	10, 144	35, 430
1946	317, 683	365, 561	683, 244	8, 168	130, 320

<sup>1</sup> None reported.

53. The statistics in table 5 indicate a variation of vessel traffic generally consistent with the fluctuating economic condition of the area as a whole, with the possible exception of the war years, when all shipping was under Government control and much of the vessel traffic was diverted from Bellingham Harbor to other ports. Except for the war period, rafted log traffic shows a general decreasing trend reflecting the gradual depletion of forest resources in the immediate

vicinity of Bellingham. During the war years considerable volumes of wood and wood products were imported from points outside the tributary area. The decline in rafted traffic since 1942 reflects the liquidation of timber holdings and suspension of manufacturing operations by one of the principal timber and sawmill interests in Bellingham Harbor.

54. Commodities produced, manufactured, or utilized in the tributary area that give rise to water-borne commerce include (1) wood and paper products, consisting principally of logs, lumber, pulp, hogged fuel, piling, paper, and miscellaneous wood products; (2) nonmetallic minerals, chiefly sand, gravel, cement, bituminous coal, lime, sulfur; (3) gasoline, fuel oil, and miscellaneous petroleum products; (4) animal and animal products, principally fish and fish products; (5) canned food products, mainly salmon; and (6) vegetable products, miscellaneous manufactured products, and merchandise. Distribution by classes of commodities is given in table 6 for the years 1941 and 1946.

TABLE 6.—*Freight traffic, Bellingham Bay and Harbor*

[Tons]

Item	Year	
	1941	1946
Foreign imports:		
Wood and paper.....	139,494	67,795
Nonmetallic minerals.....	1,214	10,134
Subtotal.....	140,708	77,929
Foreign exports:		
Wood and paper.....	40,998	13,493
Canned food products.....		5,877
Vegetable products.....	830	5,025
Manufactures and miscellaneous.....		44
Subtotal.....	41,828	24,439
Domestic coastwise receipts:		
Animals and animal products.....		1,017
Canned food products.....	38,432	25,872
Vegetable food products.....	5,519	2,119
Wood and paper.....	82,652	138,542
Nonmetallic minerals.....	17,796	6,396
Iron, steel, and machinery.....	504	4,550
Chemicals.....	4,944	3,317
Petroleum products.....	33,443	66,644
Manufactures and miscellaneous.....	15,106	9,899
Subtotal.....	198,396	258,356
Domestic coastwise shipments:		
Canned food products.....	14,662	5,716
Vegetable products.....	2,253	
Wood and paper.....	357,566	101,189
Cement.....	618	16,735
Iron and steel products.....	342	
Manufactures and miscellaneous.....	5,389	5,274
Subtotal.....	380,830	128,914
Local receipts and shipments:		
Animals and animal products (fish).....	1,080	3,409
Canned food products.....	1,941	403
Vegetable products.....	1,200	1,620
Wood and paper.....	755,183	135,271
Nonmetallic minerals.....	18,803	50,681
Cement.....	14,122	
Manufactures and miscellaneous.....	4,056	2,222
Subtotal.....	796,385	193,606
Grand total, all traffic.....	1,558,147	683,244
Additional traffic, car ferry.....	167,630	130,320

55. *Vessel traffic*.—A record of the trips and drafts of vessels operating in Bellingham Harbor is given in table 7 for the years 1937 to 1946, inclusive. A comparison of trips and drafts by type of craft is shown in table 8 for the years 1941 and 1946.

TABLE 7.—*Vessel traffic, Bellingham Harbor, 1937-46*

Draft (standard full load)	Trips <sup>1</sup>									
	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946
32 to 33 feet.....	2			4						
31 to 32 feet.....	8	2	2	6	14					
30 to 31 feet.....	10	14	12	6						
28 to 30 feet.....	86	46	62	78	42	2	4			4
26 to 28 feet.....	170	104	96	42	30	28	44	40	30	62
24 to 26 feet.....	168		208	88	114	28	18	16	8	16
22 to 24 feet.....	238	96	78	98	52	28	20	22	48	22
20 to 22 feet.....	60	54	62	40	8	8	10	16	14	42
18 to 20 feet.....	30			2		4	4	6		
Under 18 feet.....	7,022	3,240	3,962	3,808	3,362	3,344	3,254	3,196	2,916	3,402
Total.....	7,794	3,718	4,482	4,172	3,630	3,442	3,354	3,296	3,016	3,548
Passengers (regular)	12,013	14,131	8,538	8,412	3,685	7,078	9,312	8,500	10,144	8,168

<sup>1</sup> In-bound and out-bound combined.

TABLE 8.—*Trips and drafts of vessels, Bellingham Harbor <sup>1</sup>*

Standard full-draft (in feet) for years shown	In-bound <sup>2</sup>			
	Steamers	Motor vessels	Barges	Total <sup>3</sup>
1941:				
30 to 31 feet 8 inches.....	7			7
28 to 30 feet.....	20	1		21
26 to 28 feet.....	12	3		15
24 to 26 feet.....	48	9		57
22 to 24 feet.....	25	1		26
20 to 22 feet.....	4			4
18 to 20 feet.....	2			2
Under 18 feet.....	74	1,555	52	1,681
Total.....	192	1,571	52	1,815
Net registered tons.....	613,521	189,201	14,848	817,570
1946:				
28 feet 6 inches.....	2			2
26 to 28 feet.....	28	3		31
24 to 26 feet.....	6	2		8
22 to 24 feet.....	11			11
20 to 22 feet.....	21			21
Under 18 feet.....	5	1,426	270	1,701
Total.....	73	1,431	270	1,774
Net registered tons.....	226,293	169,284	94,627	490,204

<sup>1</sup> Commercial fishing and pleasure craft not included.

<sup>2</sup> Figures for out-bound traffic are not shown, as they are identical with those for in-bound traffic.

<sup>3</sup> Includes 55 trips (49,497 net registered tons) in 1941 by vessels of foreign registry; and 43 trips (37,351 net registered tons) in 1946.

56. As no record of traffic by fishing vessels and pleasure craft was maintained prior to 1947, the trips by these types of craft are not included in the tables. Records maintained by fish-processing plants and receiving stations in the harbor in 1947 and 1948 show that 3,541 and 2,047 landings, respectively, were made in those years by fishing vessels. Reliable local interests estimate that the in-bound and out-bound traffic in 1948 by pleasure craft and fishing vessels for all



purposes amounted to 4,800 and 5,100 trips, respectively. The following data furnished by the port of Bellingham show the increasing trend in the number of locally based fishing and pleasure craft:

Type of craft	Year			
	1938	1946	1947	1949
Fishing vessels.....	21	71	80	120
Pleasure boats.....	60	164	180	202

The tabulation shows that the increase in fishing vessels averaged 9 a year and in pleasure boats about 13 a year in the 11-year period. These increases occurred during a period that included several war years, when manufacture of pleasure craft was suspended and fishing-vessel operation was under wartime restrictions. They occurred also in spite of adverse moorage conditions. Local interests assert that the number of locally owned pleasure craft will be greatly increased within the foreseeable future if adequate and protected moorage is available. Because of its particularly advantageous location with respect to the cruising areas surrounding the San Juan Islands and the popular commercial and sport-fishing areas on the Rosario Straits, Hale Passage, and the Straits of Georgia, transient pleasure and fishing craft frequently visit Bellingham Harbor or seek shelter there when caught in storms. A continued upward trend in pleasure craft and fishing vessel traffic is anticipated, conditioned upon the availability of adequately protected moorage.

57. *Difficulties attending navigation.*—The several small-boat moorages in Bellingham Harbor were established by local interests in most cases to meet urgent demand for moorage facilities at the least possible cost. Consequently, all except the basin southeast of Squalicum Creek waterway are of a temporary nature and in locations unsuited for development of proper protection or for expansion. In general, they are hemmed in by industries that are also seeking space to expand. All of the existing facilities are overcrowded and boats are subjected not only to the wear and tear resulting from congestion but are also subject to damages from wind and wave action during storms.

58. Indicative of the hazards to which boats are subjected is a storm in 1943 that resulted in the sinking of seven boats, damage to other boats and to the moorage facilities. There is no record of the monetary value of the damages from this storm. A severe southwesterly storm in January 1947 damaged the port commission's South Bellingham boat haven to the extent that it was subsequently abandoned. It also caused considerable damage at the other moorages. A total of 44 boats were damaged, many of them by sinking. The losses from this storm are estimated to aggregate \$56,000, including \$37,000 in losses and damages to boats (an average of \$150 a vessel for the then existing fleet) and \$19,000 to moorage facilities.

59. Transient craft make frequent visits to the harbor and occasionally seek refuge there when caught by storms in adjacent waters. Consequently, the existing moorages have become increasingly overcrowded, particularly during storms when all small craft must seek shelter. Local interests have reported several instances when small

craft had to seek moorage elsewhere because none was available at Bellingham. The necessity of mooring vessels in close quarters, frequently several abreast, results in damages from chafing and breaking of mooring lines, rubbing and battering of hulls; and in losses from fire because of difficulty in extricating a burning vessel from a crowded moorage. Additional losses and expenses are suffered by the craft unable to find accommodations in the existing moorages during storms. Expenses also result from extra precautions taken to prevent damages and losses. These damages, losses, and precautions are estimated by local interests to amount to about \$38,600 annually, an average of \$120 a boat, of which \$21,000 is for fishing and \$17,600 for pleasure boats. These estimates are considered to be reasonable. Because of congestion, boats are at times forced to anchor in the fairways of the existing havens. This crowding results in considerable loss of time to fishing and other vessels in proceeding to and from the berths or calling at the wharves for service or unloading.

60. The space occupied by the South Bellingham boat basin is needed for log storage and expansion of the industries located on either side of the basin. The basin area adjacent to the port commission's municipal dock is needed for rearrangement and expansion of the port's terminal facilities. The space presently used for moorage at the upper end of Squalicum Creek waterway was originally designed and is still needed to provide access to the adjacent repair and service facilities.

61. *Water power and other special subjects.*—There are no problems of water power or supply, flood control, pollution, land reclamation (other than new land development by deposit of dredged material) or other subjects relating to the conservation of water resources that could be coordinated with the improvements to navigation considered herein.

62. *Plan of improvement.*—In accordance with the desires of local interests, basic features of the plans considered for a small-boat basin include provision of a protected basin with a minimum capacity of 1,000 boats (300 fishing and 700 pleasure boats) and minimum depths which have varied from 12 to 15 feet for the several alternate locations considered. Sites investigated include two on Chuckanut Bay, one at the inshore end of I and J Street waterway, and the existing basin adjacent to Squalicum Creek waterway. Dredging of a deep-water channel in I and J Street waterway was also considered in conjunction with the small-boat basin.

63. *Chuckanut Bay.*—The first plan considered a location at the head of the bay above the existing Great Northern Railway trestle and embankment, where a basin about 29 acres in area and 15 feet deep was suggested by local interests. This location is sheltered by the existing topography and the railway fill. The plan involved an entrance channel 1,000 feet long and installation of a drawbridge on the railway span. However, strong objections by the railway company to a drawbridge caused local interests to abandon this location in favor of one just outside the railway trestle. This alternate site would not involve dredging but would require a breakwater for protection. The excessive depth of water and instability of bottom material would result in a high cost for the breakwater that could not be justified by ensuing benefits.

64. *I and J Street waterway.*—A basin with an area of about 15 acres and a depth of 15 feet was considered for location at the upper

end of I and J Street waterway, as suggested by the port of Bellingham, to supplement the existing moorage of Squalicum Creek. This basin was planned for development in conjunction with a deep-water channel, and an industrial and terminal fill area also proposed for the waterway. Local interests in general considered the site suitable for a fishing-boat base but objectionable as a pleasure-boat haven because of its location with respect to potential industries and commercial traffic. In view of this objection and of the lack of a definite need for an additional deep-water channel at this time, the port later rescinded its request for both the small-boat basin and the channel.

65. *Basin adjacent to Squalicum Creek waterway (recommended plan).*—After careful reconsideration of the previously suggested sites and any other possible site in Bellingham Harbor, local interests agreed on extension of the existing basin southeasterly of Squalicum Creek waterway as the most suitable for both the fishing- and pleasure-boat fleets. The plan of improvement considered herein is essentially that suggested by local interests. It provides for (a) construction of a rubble-mound breakwater in two sections as shown on the map, one 2,025 feet long, the other 1,875 feet long; (b) removing the existing breakwater and using the rock therefrom in the new breakwater; (c) dredging to provide a basin area of about 46.7 acres at a minimum depth of 12 feet at mean lower low water. In addition to work done on the usable part of the existing basin, local interests have placed about 60,000 tons of rock to form the nucleus of the southeasterly breakwater section, have constructed about 1,360 feet of bulkhead on the easterly margin of the extended basin, and have dredged a part of the adjacent area. No appreciable benefit has been, or can be, realized from this additional work until the entire proposed breakwater protection is provided. Local interests would also provide all necessary additional moorage and service facilities, perform the remainder of the necessary dredging within the basin, and remove all pile extensions of the existing breakwater.

66. The proposed rubble-mound breakwater sections would have a top width of 6 feet, an elevation of 14 feet above mean lower low water, and side slopes of 1 on 1½. About 59,700 tons of rock would be obtained from the existing breakwater for use in the proposed structure. In addition to this and the 60,000 tons placed by local interests, about 270,000 tons of rock would be required. A suitable quarry is available at Mats Mats Bay on the westerly shore of Admiralty Inlet, about 53 nautical miles from Bellingham. Probings made in the vicinity of I and J Street waterway and material encountered in dredging of the existing basin and Squalicum Creek waterway indicate that the bottom is predominantly fine to medium sand, well compacted. The nominal maintenance heretofore required for the existing rubble-mound breakwater also indicates that a suitable foundation exists for the proposed structures. It is estimated that the work can be accomplished in less than 1 year. No initial Federal dredging would be required as prevailing depths in the proposed entrances exceed the proposed project depth of 12 feet. The proposed entrances for the basin are based on wave refraction studies made to determine the best arrangement for easy approach by vessels seeking entrance during storms and for reducing to a minimum the passage of storm wave trains into the basin.

67. *Aids to navigation.*—The Thirteenth Coast Guard District was consulted in regard to navigation aids. That office stated that three lights and a fog signal would be required. One light would be located

at the northwesterly entrance; two lights and a fog signal at the southerly entrance. The fog signal and accompanying light would be housed in a reinforced concrete building on top of the breakwater and would require some widening of the breakwater to accommodate the building. The other two lights would be housed in wood buildings resting on concrete slabs on top of the breakwater.

68. *Shore-line changes.*—The foreshore of Bellingham Bay in the vicinity of the proposed improvement is composed largely of sedimentary deposits, consisting of medium to fine, well compacted sand, with an overlay of a 3- to 4-foot stratum of organic silt from the berm to a depth of about 2 fathoms. The Great Northern Railway and a city street extend along the back shore berm. There is no indication of a predominant direction of littoral current, and except for a small amount of sediment deposited by Squalicum Creek, the shores and beach appear to be stable. As the existing breakwater and work done in the existing basin have shown no adverse effect on adjacent shores, no detrimental effect is anticipated from the proposed construction.

69. *Estimate of first cost.*—On the basis of February 1949 prices, the first cost of the proposed improvements is estimated to be as follows:

(a) Federal first cost:

(1)	Removal of existing rubble-mound breakwater (including the placing of the rock in proposed breakwater), 59,700 tons of rock at \$4-----	\$238, 800
(2)	Additional rock required for proposed breakwater, 270,000 tons at \$3.65-----	985, 500
(3)	Total cost of breakwater (Corps of Engineers)---	1, 224, 300
(4)	Aids to navigation (by U. S. Coast Guard):	
	Rock for widening base-----	\$8, 150
	Lights and fog signal-----	13, 710
	Total (U. S. Coast Guard)-----	21, 860
(5)	Total Federal first cost-----	1, 246, 160

(b) Non-Federal first cost for proposed improvements:

(1)	Mooring basin:	
	Removing existing piling-----	\$4, 000
	Dredging, 163,500 cubic yards-----	57, 230
	Dolphins at entrance-----	8, 400
		69, 630
(2)	Mooring facilities:	
	Floats, 13,500 linear feet-----	\$162, 000
	Ramps and approaches-----	2, 450
		164, 450
(3)	Terminal facilities:	
	Wharves, 30,000 square feet-----	\$75, 000
	Addition to web house-----	85, 000
		160, 000
(4)	Utilities:	
	Water and electrical distribution systems--	\$35, 000
	Roads and parking and work areas-----	25, 000
		60, 000
(5)	Total non-Federal first cost-----	454, 080

(c) Total first cost of proposed improvement----- 1, 700, 240



70. *Estimate of annual charges.*—The annual charges for the proposed work are estimated to be as follows:

(a) Federal annual charges:	
(1) Federal first cost.....	\$1, 246, 160
(2) Interest at 3 percent.....	37, 380
(3) Amortization (50-year life at 3 percent)....	11, 050
(4) Maintenance:	
Breakwater and entrance channels.....	\$15, 000
Less maintenance cost of existing breakwater....	1, 500
Total, Corps of Engineers.....	13, 500
Aids to navigation (U. S. Coast Guard).....	1, 000
Total.....	14, 500
(5) Total Federal annual charges.....	\$62, 930
(b) Non-Federal annual charges:	
(1) Non-Federal first cost.....	\$454, 080
(2) Interest at 3½ percent.....	15, 890
(3) Amortization (50-year life at 3½ percent)....	3, 460
(4) Maintenance of mooring basin, additional moorages and terminal facilities.....	18, 000
(5) Operation of additional facilities.....	9, 000
(6) Gross annual charges.....	46, 350
(7) Less revenue from additional moorage and terminal facilities.....	30, 900
(8) Net non-Federal charges.....	15, 450
(c) Total annual charges.....	78, 380

71. As the community is economically stable and progressive, a life of 50 years has been assumed for determining the annual charges. The locality is not subject to severe storms such as those prevailing on the open sea coast, and it is expected that the breakwater will readily sustain a life of 50 years without any great deterioration. As expenditures for maintenance of the existing breakwater have been nominal, the cost of maintaining the proposed breakwaters is expected to be likewise relatively small. Maintenance of the entrance from Squalicum Creek waterway would be incidental to maintenance of the waterway under the existing project. The cost of maintaining the southern entrance channel is expected to be nominal as no great movement of material is evident in the area.

72. *Estimate of benefits.*—The proposed improvement, together with the improvement already provided by local interests, would provide moorage for 300 fishing and 700 pleasure boats, or a total of 1,000 small boats. This total includes the present capacity of 180 boats. The existing temporary moorages maintained by the port of Bellingham in Squalicum Creek waterway, and at Whatcom Creek (municipal dock) would be abandoned, as the one on the south shore of Bellingham Bay has been. The new basin would provide ample space for the existing boats in Bellingham; for boats transferring from other localities; for new boats to be added as a result of the normal increase in boat population during the life of the project; for the increasing

transient traffic; and for new pleasure craft to be added in the first few years as a direct result of the improvement. The proposed improvement would directly benefit the fishing industry, recreational boating, and related activities. Items of benefit evaluated herein are incremental to those now enjoyed and include elimination of damages and losses to fishing and pleasure craft, increased fish catch resulting from time savings, and increased recreational returns from pleasure boating.

73. *Fishing industry.*—The proposed improvement would eliminate damages, losses, and precautionary expenses incurred by fishing boats basing at the various exposed moorages in Bellingham Harbor, and the wear and tear resulting from congestion in the existing fishing-boat base. Information from local fishermen and other sources indicates that the average annual expenditures for repair of damages, replacement of losses, precautionary measures, and extra maintenance total \$21,000.

74. Congestion in the existing moorages impairs the movement of vessels, resulting in loss of time that could be devoted to productive fishing. Elimination of this congestion would enable the fishermen to arrive at the fishing grounds earlier and remain there longer, and thus enable them to correspondingly increase their catch of fish without additional capital outlay. It is estimated that under existing conditions, an average of 30 minutes a trip is lost by each fishing vessel calling at Bellingham. Data given in paragraph 56 indicate an average of 2,794 landings in 1947 and 1948. Assuming a conservative annual average of 2,500 landings, the annual time savings by elimination of the 30-minute delay would total 1,250 hours. In accordance with the general practice of the locality, fishermen basing at Bellingham operate on a share basis, wherein proceeds from fishing are divided equally among the crew after deduction of boat shares and trip expenses. Crews of vessels range from three to seven men each, with an average of about four. Taking into account the various types of fishing engaged in by the Bellingham fleet, and the annual amount of fish landed in recent years, it is estimated that the 1,250 additional hours, if devoted to fishing, would result in an increased fish catch of 77,500 pounds annually, which would have a net value of \$8,500 after deducting boat operating and other trip expenses. As this catch would be an increase in the Nation's basic food supply, the net benefit would be general in scope. This figure is considered conservative as it does not include the future normal increase in the transient and permanent fleet operating from Bellingham.

75. Local interests assert that numerous inquiries relative to availability of moorage in Bellingham have been made by owners and operators of fishing craft now based at more distant points, particularly Everett, Tacoma, and Seattle on Puget Sound. The inquiries indicate that a number of fishermen are desirous of transferring their base of operations to Bellingham because of its more advantageous location with respect to productive fishing banks, because of the availability of repair and servicing facilities nearer their fishing operations, and because of certain other advantages offered by a smaller city. Local interests state that a minimum of 40 fishing vessels now based at other overcrowded Puget Sound ports would transfer to Bellingham

within a short time if adequate protected moorage is provided. These vessels now make an average of 13 trips annually from their home ports to the fishing banks on Rosario and Georgia Straits and waters of the San Juan Archipelago. It is estimated that each of those 40 boats requires on the average 11.6 hours more to make a round trip from its present base to the fishing banks than would be required from Bellingham, which is equivalent to 6,000 hours of nonproductive travel time per year.

76. By basing at Bellingham, the 40 boats could and probably would utilize the 6,000 hours of time saved in productive fishing. With an average four-man crew to each boat, the 6,000 hours would produce an additional annual catch of 372,000 pounds of fish. As transfer of the nonproductive travel time to productive fishing time would involve no change in vessel operating cost nor in crews' time, the net benefit from this fish catch would be its value at the fishermen's price level less expenses incidental to the fishing operation. The net value of the catch is thus estimated to be \$54,100.

77. *Pleasure craft.*—As the waters outside Bellingham Bay and Harbor are favored for pleasure cruising by the majority of pleasure-boat owners in Puget Sound and contiguous areas, the number of visits to Bellingham Harbor by transient craft is expected to increase materially when adequate moorages are available. To accommodate the additional transient traffic, the port of Bellingham is planning to reserve about 100 of the 700 pleasure-boat berths for transient use. The permanently based fleet of Bellingham is estimated to average 370 boats over the project life of 50 years, of which 300 boats would represent the existing fleet and anticipated normal increase over the next 10 years only, and 70 boats would represent new boats acquired as a direct result of the harbor improvement. It is further estimated that about 300 transient boats would spend an average of 4 days each, or 1,200 boat-days, annually in the harbor, which would be equivalent to full-time use of the harbor by 5 boats over an 8-month season.

78. Under prevailing conditions, the present fleet of 202 pleasure boats incurs an average annual monetary loss of about \$17,600, or \$88 a boat, resulting from vessel losses, repair of breakages and other damages, and extra precautionary measures. For the expected annual average of 300 boats the monetary loss would total \$26,400 if additional protected moorage is not provided. An adequate protected harbor such as that proposed would eliminate these annual expenses.

79. Transfer of pleasure craft from congested, inconvenient, and inadequately equipped moorages in Bellingham Harbor to a safe, adequately spaced moorage, and provision of ample berthing space for transient boats will correspondingly increase the recreational benefits enjoyed by the pleasure-craft owners. In order to evaluate in monetary terms the recreational benefits derived from ownership and operation of a pleasure boat, it is assumed herein that the recreational value of boating is a function of the capital investment and that the net benefits must exceed the costs or the recreationalist would not pay them. It is therefore assumed that the net recreational benefits are comparable to the normal net return on the depreciated capital investment in pleasure boats operated for hire, after all expenses have been paid.

80. As a basis for calculating recreational benefits, the 300-boat fleet is classified as follows with respect to type and depreciated value of boats:

- 75 outboards at \$250.
- 65 inboards at \$1,500.
- 150 cruisers at \$4,000.
- 10 auxiliary sailboats at \$3,500.

Taking into account the time spent by this local fleet away from the harbor, it is estimated that if normal conditions prevailed, the recreation benefits would be equivalent to net returns of 12 percent on the depreciated value of outboards, 11 percent on the value of inboards, and 6 percent on the value of cruisers and auxiliary sailboats. Using these factors, the recreation benefits for the 300 boats would total \$51,075 a year under normal conditions. It is estimated, however, that with the present lack of adequate moorage and protection, owners of outboard motor boats realize only 75 percent and owners of boats in the other classes 90 percent of these possible benefits. As the proposed improvements would make possible their full realization, they would in effect increase the annual benefits now enjoyed by \$5,440.

81. Local marine dealers assert that utilization of existing facilities to their capacity and lack of protection for small boats in Bellingham Harbor have resulted in the loss of about 15 boat sales a year in recent years or a total of 75 sales, and that provision of additional space and protection would be reflected directly in increased sales. It can reasonably be expected that within say 5 years after completion of the basin, a total of 75 new boats would be acquired in addition to the normal rate of increase. In calculating the benefits to be derived from stimulation of boat sales, acquisition of the new boats within 5 years would be equivalent to having an average of 70 during the project life. Assuming classification, depreciated capital value, and percentage of returns under normal conditions to be the same as in the preceding paragraph, the total recreational benefits for the 70 new boats would be \$11,840, which would be wholly attributable to the harbor improvement. In addition to the benefits to be realized by the locally based existing and new fleets, the 300 transient boats would receive benefits during their use of the harbor. As indicated in paragraph 77, these 300 transients would be equivalent to 5 permanently based boats. Assuming that they are cruisers and subject to recreation returns similar to the new boats acquired by reason of the improvements, the annual benefit for them would amount to \$1,200.

82. The improved harbor would aid materially in further stabilizing the economy of the locality through its enhancement of business activities related to commercial fishing and recreational boating. It would provide a harbor of refuge for small craft such as rowboats caught in squalls while engaged in salt water sports fishing. These small craft are generally kept in dry storage when not in use and therefore are not included in the foregoing calculations for pleasure craft. Although evaluation of these benefits on a monetary basis is not practicable, they would increase the value of the basin to the community and to the general public.



83. The benefits outlined in the preceding paragraphs are summarized and distributed between public and local interests as follows:

	Total	General	Local
(a) Fishing craft:			
(1) Elimination of damages, losses, and expenses for their prevention.....	\$21,060	\$21,000	-----
(2) Net value of increased fish catch.....	62,600	62,600	-----
(b) Pleasure craft:			
(1) Elimination of damages, losses, and expenses for their prevention.....	26,400	26,400	-----
(2) Increased benefits to existing locally based craft.....	5,440	2,720	\$2,720
(3) Recreational benefits to new craft.....	11,840	5,920	5,920
(4) Recreational benefits to transient craft.....	1,200	600	600
(c) Total.....	128,480	119,240	9,240
(d) Percent.....	100	93	7

84. *Comparison of benefits and costs.*—The annual benefits and costs of the proposed plan of improvement are compared as follows:

(a) Annual benefits.....	\$128,480
(b) Annual costs.....	\$78,380
(c) Ratio, benefits to costs.....	1.64

85. *Proposed local cooperation.*—The extent of cooperation offered by local interests is outlined in paragraph 51. As an essential feature of Federal participation in the plan of improvement considered herein, local interests should be required to furnish assurances that they will—

(a) Furnish free of cost to the United States all lands, easements, disposal areas, and rights-of-way necessary for the construction and maintenance of the improvement when and as required, including title to that portion of the new breakwater constructed by local interests, and including the right to remove rock from the previously constructed breakwater for use in the proposed Federal work;

(b) Hold and save the United States free from property damages that may result from the construction and maintenance of the improvements;

(c) Remove the timber-pile portions of the existing breakwater as shown on the accompanying plans, perform all dredging required to complete the basin to a depth of 12 feet at mean lower low water, and maintain the basin and the entrance channels shoreward of the pierhead line to project dimensions thereafter;

(d) Provide and maintain any addition bulkheads that may be required for retention of the dredged material;

(e) Construct protective dolphins at the ends of the breakwater when and as required;

(f) Provide, maintain, and operate without profit, necessary mooring facilities, utilities, and a public landing with suitable service and supply facilities open to all on equal and reasonable terms.

86. *Allocation of costs.*—In general, the costs of the improvements considered herein would be allocated between Federal and local agencies as indicated in the cost analysis heretofore made. The Corps of Engineers would bear the first cost of removing the existing rubble-mound breakwater, and constructing the new breakwater, estimated at \$1,224,300, and the annual cost of maintaining the breakwater and of maintaining the entrance channels outside the pierhead lines, estimated at \$13,500 additional to that required for the existing project.

The United States Coast Guard would assume the cost of \$21,860 for aids to navigation and \$1,000 annually for their maintenance. Local interests would bear the first cost of removing the existing timber-pile breakwater, dredging the basin, and constructing additional moorage, terminal and other facilities and utilities (including any alterations that may be required), estimated at \$454,080; and the annual cost of maintaining the mooring basin and maintaining and operating the additional moorage and terminal facilities and utilities estimated at \$27,000. However, of the local annual charges, only \$15,450 (representing a capital outlay of some \$362,400) would be non-self-liquidating. This, in effect, would represent the extent of local contribution to the project. Local benefits constitute about 7 percent of the annual benefits. In comparison, the local item of \$15,450 amounts to about 20 percent of the net annual cost, thus indicating that no further cash contribution should be required of local interests.

87. *Coordination with other agencies.*—During the course of this investigation, representatives of pertinent Federal agencies, such as the United States Coast Guard and the United States Fish and Wildlife Service, were consulted. Each agency approved the proposed improvements in general. Pertinent State and local governmental agencies were also consulted and their views and comments were given full consideration. All have approved the proposed plan of improvement and have given assurance of their cooperation in its accomplishment.

88. *Discussion.*—Bellingham Harbor is advantageously situated with respect to the fishing banks and cruising areas of Rosario and Georgia Straits and the waters of the San Juan Archipelago. Bellingham is one of the nearest United States ports to Alaska. Because of its natural advantages, land transportation connections, and improvements made by local interests, it has become an important fishing, fish processing and distributing center. In addition to the local fisheries, a large corporation engaged mainly in Alaskan fishing has established its headquarters and fishing fleet base there. These activities and the increasing interest in recreational boating have resulted in a substantial increase in use of the harbor as a base for fishing and pleasure boat operation.

89. Although the harbor is protected to a certain extent by islands to the south and southwest, southerly and southwesterly storms are a source of considerable hazard to small boats moored in the harbor. As a result of storm damages and the need for moorage, local interests have attempted to provide temporary moorages at various points on the harbor so far as available funds would permit. Temporary small-boat basins were developed in areas where the greatest amount of moorage could be obtained in the quickest possible time and at the lowest possible cost. Consequently, these temporary bases have been inadequate in construction and size, and have been generally located in areas that are needed for general port terminal and industrial expansion. A typical example of the inadequacy of existing moorages is the basin constructed by the port commission in South Bellingham. Partial destruction by a southwesterly storm in 1947, expensive maintenance cost, and limited capacity have resulted in its abandonment as a boat haven. Other small-boat moorages in the harbor are similarly inadequate and unsafe. Local interests have consequently undertaken the development of a permanent small-boat harbor south-

easterly of Squalicum Creek waterway with sufficient capacity to provide for the present fleet of fishing vessels and pleasure craft and any anticipated increase in the foreseeable future. Having exhausted available local funds, including past expenditures of \$485,850 for moorage and terminal facilities in connection with the boat harbor, local interests have requested Federal assistance in completion of the project. Some of these facilities are not usable until further improvement is made.

90. The proposed plan of improvement is basically that requested by local interests. This improvement would provide a basin with a capacity of about 300 fishing boats and 700 pleasure craft. This is considered adequate but not excessive as at the present rate of increase at Bellingham the fishing boat base could conceivably be filled within about 16 years, and the pleasure-boat section of the basin could be filled in about 32 years if no allowance is made for transient berths. The Federal first cost of providing the necessary protection is estimated at \$1,246,160 (including \$1,224,300 for improvements by the Corps of Engineers and \$21,860 for Coast Guard aids to navigation). The Corps of Engineers annual cost for its maintenance and for maintenance of entrance channels is estimated to be \$13,500 in addition to that required for the existing project. The first cost of work remaining to be done by local interests is estimated at \$454,080. The annual cost of local maintenance and operation of the additional moorage and terminal facilities and maintenance of the mooring basin and entrance channel shoreward of the pierhead line is estimated at \$27,000. Funds to be expended by local interests for essential features of the small-boat harbor are considered to be a liberal local contribution toward the project in view of the substantial general benefits to be realized.

91. Total annual charges would be \$78,380 and the benefits to be derived from the contemplated improvements are estimated to amount to \$128,480, giving a favorable benefit to cost ratio of 1.64 which indicates that the improvements are justified.

92. *Conclusions.*—From data presented and discussed in this report, it is concluded that—

(a) There is a definite lack of adequate moorage facilities for small boats in Bellingham.

(b) The most practicable plan for alleviating this hazard is the expansion of the existing small-boat harbor southeasterly of and adjacent to Squalicum Creek waterway.

(c) Expansion of the existing small-boat harbor would be of sufficient general benefit to commercial fishing and pleasure craft navigation to warrant participation by the Corps of Engineers in its accomplishment, at a first cost of \$1,224,300.

93. As the proposed expansion can be accomplished in less than 1 year, funds for its accomplishment should be allotted in one lump sum.

94. *Recommendations.*—In view of the foregoing, it is recommended that the existing project for Bellingham Harbor be modified to provide for a small-boat harbor adjacent to Squalicum Creek waterway by (a) constructing a rubble-mound breakwater in two sections, one 2,025 feet long, the other 1,875 feet long; (b) removing the existing rubble-mound breakwater and using the rock therefrom in the new breakwater; and (c) maintaining the entrances to the basin at a depth

of at least 12 feet below mean lower low water; all at an estimated first cost to the Corps of Engineers of \$1,224,300 and an annual cost of \$13,500 in addition to that required for the existing project. It is further recommended that, before a Federal expenditure is made, responsible local interests be required to furnish assurances satisfactory to the Secretary of the Army that they will, without cost to the United States (a) furnish all lands, easements, disposal areas, and rights-of-way necessary for the construction and maintenance of the improvements when and as required, including title to that portion of the proposed breakwater already constructed by local interests, and including the right to remove rock from the previously constructed breakwater for use in the proposed Federal work; (b) hold and save the United States free from property damages that may result from the construction and maintenance of the improvements; (c) remove the timber-pile portions of the existing breakwater, perform all dredging required to complete the mooring basin to a depth of 12 feet at mean lower low water, and maintain the basin to project dimensions; (d) provide and maintain any additional bulkheads required for retention of the dredged material; (e) construct protective dolphins at the ends of the breakwater when and as required; and (f) construct in accordance with plans approved by the Secretary of the Army, maintain, and operate without profit, adequate moorage facilities, utilities, and a public landing with suitable service and supply facilities open to all on equal and reasonable terms.

L. H. HEWITT,  
*Colonel, Corps of Engineers,*  
*District Engineer.*

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[First endorsement]

OFFICE, DIVISION ENGINEER,  
NORTH PACIFIC DIVISION,  
CORPS OF ENGINEERS,  
*Portland 5, Oreg., July 15, 1949.*

To: The Chief of Engineers, Corps of Engineers, United States Army,  
Washington 25, D. C.

I concur in the views and recommendations of the district engineer.

O. E. WALSH,  
*Colonel, Corps of Engineers*  
*Division Engineer.*

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## TIDAL DATUM

Datum Plane	Elevation in feet referred to M.L.L.W.	
	Bellingham <sup>(1)</sup>	Chuckanut Bay <sup>(2)</sup>
Highest Tide	11.50 <sup>(3)</sup>	11.50 <sup>(3)</sup>
Mean Higher High Water	8.60	8.40
Mean High Water	7.80	7.70
Mean (Half) Tide Level	5.20	5.10
Mean Sea Level (1929 G.A.) <sup>(5)</sup>	4.89	4.80 <sup>(4)</sup>
Mean Low Water	2.60	2.50
Mean Lower Low Water	0.00	0.00
Lowest Tide	-4.50 <sup>(3)</sup>	4.50 <sup>(3)</sup>
U.S.E.D. Datum	0.14	

- (1) Based on one year (September 1934 - August 1935) of automatic gage operation by U.S. Coast & Geodetic Survey.  
 (2) Based on 56 high and low waters (July 23-August 20, 1888) observed by U.S. Coast & Geodetic Survey.  
 (3) Estimated.  
 (4) Approximate.  
 (5) M.S.L. (1929 G.A.) connection by U.S.C. & G.S. in 1915.

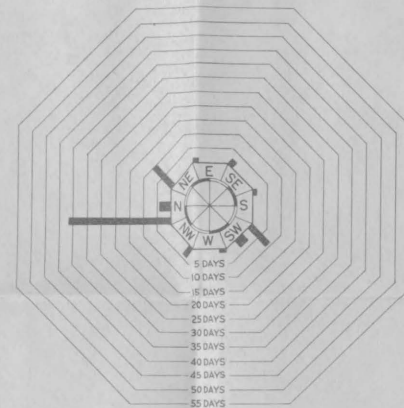
## EXISTING PROJECT

## SQUALICUM CREEK WATERWAY

- Channel 200 ft. wide, 26 ft. deep (A)  
 Westerly end of waterway, 26 ft. deep (B)  
 Easterly part of waterway, 26 ft. deep (C)  
 Breakwater 1400 ft. long, to a crest height of 14 ft. (D)

## WHATCOM CREEK WATERWAY

- Channel 363.2 ft. wide, 26 ft. deep (E)  
 Channel 363.2 ft. wide, 18 ft. deep (F)



## LEGEND

VELOCITY RANGE M.P.H.	FORCE BEAUFORT SCALE
0 TO 10	Not shown
OVER 10 TO 20	3, 4 & 5
OVER 20	5, 6 & over

Period - Jan. 1945 through May 1947.

WIND DIAGRAM  
BELLINGHAM, WASH.